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Strategic approaches to freshwater management

Report of the Secretary-General

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I. Introduction

1. The comprehensive assessment of the freshwater resources of the world (E/CN.17/1997/9), which was submitted to the Commission on Sustainable Development at its fifth session and to the General Assembly at its nineteenth special session, concluded that currently about one third of the world's population lives in countries that are experiencing moderate-to-high water stress, and by the year 2025 as much as two thirds of the world's population could be living under similar levels of water stress. The implications for developing countries are evident from the fact that a full three quarters of the population living under conditions of moderate-to-high water stress – amounting to 26 per cent of the total world population – are located in low-to-lower middle income countries. There is reason to fear that by 2025, countries in those income categories and experiencing those levels of water stress could amount to 47 per cent of the total world population. Water stress of a different kind but just as serious is found in countries located in arid and semi-arid areas, including much of sub-Saharan Africa, which are characterized by water shortages in spite of low levels of water use even relative to low availability, due to a lack of financial resources, technical expertise and institutional support. The assessment concludes that water shortages and pollution are causing widespread public health problems, limiting economic and agricultural development and harming a wide range of ecosystems. Those problems may threaten global food supplies and lead to economic stagnation in many areas of the world. The result could be a series of local and regional water crises, with serious global implications.

2. The present report has been prepared with a view to facilitating the intergovernmental dialogue called for in paragraph 35 of the Programme for the Further Implementation of Agenda 21, which was adopted by the General Assembly in its resolution S-19/2 of 28 June 1997. The report highlights key issues requiring urgent attention, and identifies starting points for taking strategic action for sustainable development in the context of the recommendations contained in chapter 18 of Agenda 21 and emanating from other international water conferences (see also E/CN.17/1997/17/Add.1, sect. VI).

II. Problem clusters: identification of areas for action

3. Water quality is somewhat more amenable to policy choice since raw water and wastewater can be treated. In the face of a widening gap between demand and supply in terms of both quantity and quality, what is entirely determined by policy is the approach to water resource management and the subsequent planning of investment in water infrastructure. To date, most approaches at the national level have been supply led and authority over the allocation of the freshwater resources has been held ultimately by the State through declarations of public interest and the use of public funds. That style of intervention is proving unsustainable, particularly in developing countries with burgeoning populations and limited financial resources.

4. As societies' demands for water supplies grow and become more concentrated in urban areas, competition for freshwater between economic sectors is increasing in many countries, particularly in arid and semi-arid zones. Competition is particularly intense between sectors looking for large volumes of low-quality water (irrigated agriculture) and those looking for small volumes of high-quality water. Disputes over limited resources have and will continue to develop between agricultural, industrial and urban users unless water management measures to prioritize household water supply are taken.

5. The need for integration and orderly management of sectoral issues thus remains essential. Three sectoral uses stand out as being of particular importance: drinking water supply and sanitation, water for agricultural production, and the utilization of clean and efficient technologies for the use of water in industrial production. Each of those uses generates demand for a different type of water: irrigated agriculture will generally use untreated water, industry may demand bulk supplies to be treated to varying standards and water-supply business requires acceptable bulk supplies that it can then treat to potable retail standards. In addition, three principal non-sectoral issues stand out: progressively degraded hydro-environments, chronically undervalued water resource assets and serious institutional weaknesses.

A. Access to urban and rural water supply and sanitation services

6. In spite of efforts during the International Drinking Water Supply and Sanitation Decade, about 20 per cent of

the world population lacks access to safe water and about 50 per cent lacks access to adequate forms of sanitation. Current trends in the provision of services remain insufficient to achieve full service coverage in the near future. For sanitation in particular, the Water Supply and Sanitation Collaborative Council meeting held in November 1997 at Manila, the Philippines, concluded that at present rates of progress, the world cannot achieve full service coverage by the year 2100. Breakdowns in public health as a result of insufficient coverage and the poor operation and maintenance of existing water supply systems are now frequent, though rarely reported until spectacular rates of epidemiological transmission occur. The problem of water supply and sanitation is particularly acute in dense urban areas, where construction has overtaken the rate at which reticulated supply systems and sanitation services can be installed economically and within the financial capacity of municipalities. Many large towns and cities in developing countries experience chronic losses of pressure in piped water distribution systems and high leakage rates when subjected to pressure. Combined with a lack of sufficient water treatment, the ingress of polluted soil and groundwater into such systems has become a major source of water-borne disease and poses serious threats to public health.

7. Rural communities are generally well dispersed within a watershed and have intimate links with small-scale catchments and aquifers, although there is evidence that those localized sources are becoming increasingly polluted from pit latrines and waste heaps. As to the rapidly growing peri-urban communities, they remain ignored by reticulated urban systems that may have been designed many years before the location and rate of growth was anticipated. Consequently, peri-urban communities are often thrown back onto highly localized sources of water that are severely contaminated due to the concentration of habitation with rudimentary sanitation arrangements and unregulated industrial activity.

B. Water for sustainable food production and rural development

8. The water demands of irrigation schemes to satisfy grain production take up the bulk (about 85 per cent) of the world's mobilized water resources. Many schemes are operating well below their design levels because of poor operation and maintenance, as well as inequitable distribution, with tail-enders always receiving smaller allocations than designed. Lack of drainage often leads to waterlogging and salinity, taking land out of production and further degrading surface and groundwater.

9. The concept of national food security loses much of its significance in an increasingly global economy. Water resources need not necessarily be allocated to the production of food if they can be used more profitably in other sectors of the economy, thereby generating the necessary income to import food products. Accordingly, countries are striving to make a transition from food self-sufficiency, in which the country is wholly dependent on domestic production, to food self-reliance, in which both domestic and international markets are used to supply the requirements. However, the transition from an agricultural to an industrial economy needs to be carefully managed if serious social inequities and geographic dislocations are to be avoided. Rural communities in developing countries that depend on subsistence agriculture are closely linked with small first-order catchments and the water, biomass and soil resources that they contain. Such linkage dominates subsistence and economic productivity through cash crops cultivation and livestock rearing but does not tend to appear in national economic budgets until water resource availability declines and remedial intervention is required to avoid starvation and migration.

C. Growth in the demands and impacts of industrial use

10. The potential for water conservation and the use of clean technologies to manage demand and minimize the environmental impact of effluent disposal is high when industrial sectors are well regulated, with access to capital and technology. Unfortunately for many developing countries and economies in transition, the push to allow industrial sectors to grow has left environmental regulation behind. That situation, combined with a lack of access to capital and clean technology, has resulted in insignificant investment in wastewater treatment, with downstream users being forced to internalize the costs of treatment.

D. Degraded environments

11. The continued neglect of water resources requirements for ecosystems – in terms of both quantity and quality – is having devastating consequences for natural capital, aquatic biodiversity and human health. That type of breakdown is communicated down the water and sediment cascades, having an impact well beyond the original source of the

degradation and even into coastal marine environments. As pressure for farm land increases, the impact on mountain and forested areas mounts and the ability of those catchment areas to buffer runoff to watercourses and recharge areas is compromised. Superimposed on environmental degradation is the impact of climatic variability, which determines the range of hydrological responses to extreme climatic events (droughts and floods). The linkages of water to biodiversity and land degradation, particularly in arid and semi-arid zones, are also significant. In particular, groundwater plays a pivotal role in buffering the effects of drought. However, the increasing contamination of groundwater, overpumping well beyond replenishment rate, and the unplanned depletion of fossil groundwater systems are threatening many urban centres, particularly in arid and semi-arid zones.

12. The balance between environment and development needs to be founded on a clear understanding of the environmental systems and the resources that they can furnish without compromising their overall long-term integrity. The economic implications of environmental degradation and ignorance of climatic variability can account for significant percentages of gross domestic product in lost productivity. However, their direct costs are often internalized by downstream users and their long-term economic implications (including *in situ* values) and over-utilization are rarely factored into long-term marginal costing for investment in infrastructure.

E. Undervalued water resources

13. The economics of water resources rarely influence water policy, even in water-short regions. As a result, the principal asset – the water resource base – remains highly undervalued and readily used without much concern for its value to others, the structural role of water in the economy and its *in situ* value as an environmental asset.

14. Although many countries have policies that prioritize categories of water use, particularly in times of shortage, very few have implemented regulations or incentives designed systematically to use water in an economically efficient manner. Water tariffs rarely reflect long-run marginal costs, let alone full economic pricing, including opportunity costs and pollution charges. Consequently, all types of water remain undervalued in economic terms and the associated water services severely underpriced. That miscalculation continues to result in profligate use within some sectors – notably agriculture – and chronic shortages to meet basic human needs. More importantly, there is no clear economic signal sent to competing sectoral users or to the state organizations responsible for regulating freshwater resource use and allocating resources among economic sectors.

F. Weak institutional and regulatory frameworks

15. Water institutions in many developed and developing countries remain relatively weak, unable to command regular budget allocations and deprived of the policy instruments and management tools to implement sound water management. The failure of institutions to implement progressive policies is often linked as much to a lack of public awareness and consensus as to lack of financial resources. In reaching out to diverse and diffuse national populations, even well crafted technocratic solutions have failed to make the expected impacts when not accompanied by serious attempts to involve consumers in urban and rural areas. Many spatial disparities are evident at subnational levels, with remote regions and districts lagging behind the central zones of economic activity in terms of water service provision. The weakness is reinforced by the tendency to mix policy-making, regulation and operational functions in single institutions.

III. Key issues in freshwater management: implications for policy choices and management options

A. Current gaps in freshwater management

1. Overall lack of awareness of the scope and function of freshwater management

16. Overall awareness of the hydro-environmental limits to water resource mobilization is generally poor. Political commitment and public education to promote resource protection and conservation – except in countries with limited options – is inadequate. Indeed, awareness of water issues is usually only heightened in times of extreme shortage or dramatic degradation in quality, with little attention given to long-term preventive measures.

2. Absence of explicit linkages with socio-economic development

17. The explicit linking of water issues to human development and economic productivity is generally lacking

both in terms of national policy declarations and supporting legislative and administrative support. One of the most important consequences of that gap is the extremely low importance attached to the integration of physical and socio-economic information.

3. Declining capacity to assess the availability and variability of water resources

18. The effective assessment and management of water resources, including the prevention and mitigation of water-related disasters, is not possible without adequate physical and socio-economic information flows. Yet the capability to provide accurate water quality and quantity data is deficient in many countries. For years, the capacity of hydrological offices in developing countries, particularly in Africa, has been declining in terms of operation and maintenance and the extent of hydrologic networks. Few, if any, developing countries have a significant capability for water quality monitoring. In addition, the fragmentation of national organizations dealing with water resources assessment and the lack of integration of hydrological and land-use data, as well as of economic and demographic data, severely limit the usefulness of existing information. The possibility of climate change increases uncertainty concerning the variability in the distribution of water resources. The trends in hydro-environmental behaviour induced by climatic variability and current consumption patterns are now posing unprecedented problems for water resource managers, making their tasks increasingly complex.

4. Mobilization of financial resources

19. The mobilization of financial resources to develop, utilize and manage water resources is lagging behind actual sectoral needs. The annual total investments required for the effective assessment, development and utilization of water resources, including wastewater treatment, greatly exceed the capacity of Governments and the international community under current patterns of financing. According to the World Bank, the overall level of current investment in water-related infrastructure in developing countries amounts to US$ 75 billion annually, with about US$ 15 billion being allocated for hydropower, US$ 35 billion for irrigation and drainage, and US$ 25 billion for water supply and sanitation. The financial resources necessary to achieve full water supply and sanitation coverage by the year 2000 are estimated to be more than three times the current rate of expenditure. It is also proving very difficult to mobilize financial resources for investment in wastewater treatment and this will continue to limit improvements in water quality. It is now clear that whatever approaches to regional and local government are taken, Governments will never be in a position to extend more services to local underserved population groups from government budgets alone. And although external support agencies have and will continue to play an important role in generating financial resources, that contribution will constitute only a small percentage of the total requirements. Only the adoption of pricing policies geared towards cost recovery will enable the public and private sectors to generate the financial resources needed for capital investment and for operation and maintenance.

B. Implications for action: guiding principles and strategic themes

20. Strategic approaches to freshwater management need to be based on a set of principles if they are to work progressively towards the goals of equity and sustainability. Those principles and themes have evolved since the United Nations Water Conference held at Mar del Plata, Argentina, in 1977, through the ensuing set of international conferences, including the 1990 New Delhi Global Consultation on Safe Water and Sanitation, the 1992 Dublin International Conference on Water and the Environment, the subsequent elaboration in chapter 18 of Agenda 21 by the United Nations Conference on Environment and Development and the 1994 Noordwijk Ministerial Conference on Drinking Water and Environmental Sanitation, and now offer a guiding framework upon which specific actions can be based. In addition, those principles were reinforced or elaborated by other major recent United Nations conferences, including the Global Conference on the Sustainable Development of Small Island Developing States, held at Bridgetown, Barbados, in 1994; the World Summit for Social Development, held at Copenhagen in 1995; the United Nations Conference on Human Settlements (Habitat II), held at Istanbul in June 1996; and the World Food Summit, held in Rome in November 1996. Those principles are summarized below.

1. Integrated management as an overall approach

21. Integration of all water-related activities through a mix of institutional and economic instruments is a key requirement for addressing the goals of social welfare, environmental integrity and economic productivity. In striving to reconcile socio-economic demands with available resources, three fundamental areas of action may be recognized: (a) the pivotal role of participation and the principle of subsidiarity, (b) the role of economics and financing in driving productivity gains, and (c) the need to

protect hydro-environmental integrity and recognize environmental limits. Addressing specific water issues under each of these areas requires awareness and political commitment. Awareness-raising must be matched by incentives to change. Clear economic signals may do some of this by, for example, informing consumers of current and future costs or by indicating levels of profligate use. If it is to be effective at all, a carefully orchestrated initiative of public education, pricing policy and engagement of consumer and interest groups needs to be considered.

22. An open, transparent and continuous process of consultation and participation is essential if national water resources are to be managed in an equitable and sustainable fashion and resources found to extend water services to those currently deprived of access to water and sanitation. The role of regional and central government as policy maker and provider of technical support must be complemented by local (district level) government action as a mobilizer or promoter of community-based management to yield positive results in terms of health, income generation and environmental protection.

2. Water allocation policies to satisfy basic human needs and promote employment and income generation

23. Failure to adapt to the finite nature of water as a resource and to recognize its social and economic value is leading to haphazard sectoral allocations in water, as well as suboptimal impacts on employment and income generation and the satisfaction of basic needs. An integrated approach to the efficient and equitable development and allocation of water resources requires the use of economic and regulatory instruments designed to maximize social net benefits. The use of market and non-market instruments to allocate water resources has received much attention in recent years. Although administrative solutions and the rigorous application of laws and regulations are more commonly used to allocate water, market mechanisms are increasingly being introduced. The pricing of bulk and retail water at somewhere near the long-term marginal cost is becoming inevitable as subsidies become unrealistic or are no longer found to be acceptable. Nevertheless, in setting up tariffs, there is a need to accommodate those sectors of the population that cannot afford minimum levels of services. Pollution charges send economic signals to users, encouraging wastewater treatment and reuse. Informal markets in both bulk water and water services are used by many rural economies in which transactions between neighbouring farmers and transient demands and supplies (agro-pastoral communities, for example) are arranged. Such markets occur in an unstructured way and can involve a degree of self-regulation, particularly in semi-arid zones with long dry seasons. In some circumstances, informal groundwater markets are proving unsustainable as farmers seek to maximize agricultural output in the short run. Formal market mechanisms have been used under special circumstances in which infrastructure and regulation allow the marketing of user rights and where the sectoral competition is severe, such as between the agricultural and urban sectors in California or in the case of Chile.

24. Regulatory and economic instruments also need to be designed to maintain the overall stock of environmental assets linked to freshwater. It is incumbent upon the international community to demonstrate the full range of tools that can be used to allow national policy makers to select those that are most appropriate and for the use of which consensus can be obtained. As countries review their water legislation, the first thing that is usually examined is enhanced regulation and enforcement. However, the resources are rarely available to enforce detailed regulations and standards. Legal and institutional arrangements can perform an important enabling function since they may significantly influence the manner in which individuals, institutions and enterprises relate to natural resources. Equally, the recognition of customary uses and water rights can enhance trust in government activities and programmes. Allowing socially and environmentally acceptable transfers of water and land rights may also encourage more productive uses.

3. Institutional reform: separation of policy, regulatory and operational functions

25. The drive towards integrated management might suggest the need for a government authority responsible for all aspects of the hydrological cycle. However, experience with water resource management demonstrates the need for a clear separation of policy, regulation and operational functions, the commercial autonomy of water service utilities, and for adapting existing arrangements to promote integrated water resources management at a technical level. For that to happen, a policy dialogue to adapt mandates and responsibilities has to be initiated. Despite the common perception that the water utility business is currently being deregulated as state monopolies are commercialized or privatized, there is a need to reregulate to allow private actors and financially autonomous water utilities to engage in a fair and transparent commercial environment and protect public and environmental interests.

4. Negotiation of shared transboundary water resources

26. The recently agreed Convention on the Law of the Non-Navigational Uses of International Watercourses (see A/51/869) as well as existing regional agreements and conventions provide the basis of negotiation. By addressing individual national priorities within the framework of those recommendations, it is expected that individual countries can work towards mutually beneficial sharing arrangements. Sharing key sets of data and agreeing on social and economic principles often prove essential in making progress in such negotiations.

5. Improved information management and information flows

27. The demand for linked hydrological and socio-economic information needs to be clearly established if information gathering systems are to receive sufficient support. Relevant and detailed hydrological and socio-economic information is as much for planners and managers as for policy makers and water users, and an adequate flow of information is needed to alert planners to trends and potential gaps.

6. Progressive financing of all water-related services, including irrigation and drainage and sanitation

28. The financing of water (including irrigation and drainage) and sanitation services can no longer be assumed to be an exclusive role of the State, even though the public interest in water and sanitation services is high. There is clearly a great scope for the improvement of cost recovery in water infrastructure and demand management of water use at the national level. Governments and communities are turning to alternative actors, such as autonomous public utilities, large multinational companies who are prepared to invest in urban infrastructure or small village communities committed to improving their use and management of limited water resources, to contribute capital and expertise. As the fiscal pressure mounts for the State to withdraw from direct investment in water services, the transfer of operational responsibility and ownership to various user groups requires careful planning. For larger-scale investments in flood control, hydropower and municipal supplies and wastewater treatment, State-controlled corporations or State-guaranteed support contracts to the private sector have become necessary. Lessons learned from the uneven success of such public-private partnerships have led to improvements in the forms and methods of partnership and to the recognition of the need for adequate regulation. This calls for a fresh examination of the role of economic instruments, the contribution of consultative and participatory processes, the enabling functions of legislation and customary law and a fundamental appreciation of the value of the physical processes that bind hydro-environmental systems.

IV. Strategic actions

29. In dealing with a resource in which the public interest is high and whose environmental role is vital, certain principles of equity, transparency, efficiency and sustainability should be respected. There is a need to identify the starting points in a process of adaptation so that well informed policy choices and management options can be taken at the local, national and regional levels. This process of adaptation and innovation is an iterative process that needs constant revision as environmental and socio-economic changes take place. It also needs to be able to reconcile long-term visions for water management with short-term realities that apply in specific countries and regions.

A. Promoting ownership and participation of key user and interest groups

30. The engagement of key user and interest groups, including women, in rural and peri-urban zones, municipalities, farmers, industrialists and non-governmental organizations is necessary if such stakeholders are to play their respective roles in progressive freshwater management. If Governments are to disengage from the centralized provision of services, then the burden of responsibility for financing, operation and maintenance of water infrastructure falls to the user groups. Conditions for such participation requires the clear identification of the actors, their rights and responsibilities in relation to water. This will usually require the formulation of a water code and a parallel process of open consultation and engagement of stakeholders through public forums and meetings.

B. Promoting productivity gains and sustainability through enhanced regulation and the use of economic instruments

31. The joint use of regulatory and economic instruments needs to be promoted to create the conditions for the productive and sustainable engagement of all economic agents. Identifying stable water user rights and permitting their transfer on open markets, subject to tests of beneficial use, may be one way to formalize currently unstructured water trading and create opportunities for productivity gains through a more efficient use of land and water resources. Formal negotiation and trading in water and pollution at the basin level among industry, municipalities and rural communities and users upstream and downstream is more complex, but can be started once a clear picture of environmental constraints and economic opportunities is drawn up. Since most economies can no longer afford to supply bulk and retail water in simple response to demand, demand management will become more important. Water efficiency gains in irrigated agriculture offer the best opportunity for reducing demand for bulk water and high-quality groundwater. Here, issues of land tenure and water user rights need to be addressed in designing policy reforms.

C. Promoting sound sectoral policies and improving sectoral coordination

32. Sectoral imperatives need to be addressed within an integrated framework, but the implementation of innovative strategic approaches will occur within well defined sectoral limits. The types of key sectoral actions that can be considered are set out below.

1. Water supply and sanitation: a major international effort towards universal coverage

33. As we look towards the start of the twenty-first century, it has become painfully evident that nothing short of a major initiative at the national, regional and global levels will lead towards achieving the ultimate objective of full water supply coverage in the early years of the new century and generate the needed momentum towards the provision of basic sanitation services. A starting point is the speedy implementation of the recommendations contained in the Action Programme of the Noordwijk Ministerial Conference on Drinking Water and Environmental Sanitation. Particular attention is drawn to the Conference's recommendation concerning the need to undertake resources assessments to produce an inventory of the current situation, and to identify problems and constraints in providing water supply and environmental sanitation services. The Conference also recommended the development, review or revision, by 1997, and the implementation in the context of national sustainable development strategies, consistent with Agenda 21, of measures for drinking water and environmental sanitation, taking into account the goals set by the World Summit for Children. The Forward Looking Assessment on the Implementation of the Action Programme on Drinking Water and Environmental Sanitation (see E/CN.17/1997/15) urged countries to review their policies, giving increased priority to improving sanitation services and focusing on five key components of sustainability (social, environmental, institutional, financial and technical). Specific actions recommended in this area include:

(a) At the national level:

(i) Promotion of participation of local communities, including women and the poor, and user groups;

(ii) Development of urban and rural development strategies for improving the incomes of the urban, peri-urban and rural poor, together with the provision of improved water supply and sanitation services;

(iii) Promotion of partnerships between the public and private sectors, and between national and local institutions;

(iv) Development of strategic approaches for the provision of adequate financial resources for water supply and sanitation improvements, including economic mechanisms for promoting efficient water use and cost recovery.

(b) At the regional and global levels:

(i) Strengthening of regional and international cooperation for the exchange of information on national experiences in water supply and sanitation improvements, by establishing or strengthening clearing house mechanisms to promote the sharing of successful experiences and water technologies;

(ii) Assistance to Governments, at their request, in creating an enabling institutional and legislative environment for the effective contribution of public and private utilities to the provision of water supply and sanitation to urban and rural communities.

2. Water and health

34. With water a primary agent in maintaining human health and transmitting disease, the imperative remains to

manage all freshwater sources to maintain chemical and biological quality within minimum acceptable standards. This can only be realized if adequate attention is paid to the treatment and management of wastewater from all sectors. Key actions that will work towards protection and improvement of water quality include:

(a) At the national level:

(i) Priority for sanitation, including the provision of safe excreta disposal services at relatively low cost, and education on personal hygiene;

(ii) Mitigation and disaster preparedness in order to ensure prompt action to limit adverse effects on health.

(b) At the regional and global levels:

(i) Monitoring of bacteriological and parasitic water-borne diseases at the basin level;

(ii) Prevention or minimization of the contamination of water by heavy metals and other chemicals.

3. Water and food security

35. The management and use of water resources for agriculture needs to be seen in the context of competing demands for the resources, and of the fact that more than 500 million people throughout the world, particularly in developing countries, do not have enough food to meet their basic nutritional needs. In pledging their political will and their common national commitment to achieving food security for all and an ongoing effort to eradicate hunger in all countries, the participants at the 1996 World Food Summit stressed the need to achieve increased food production, including staple food, within the framework of the sustainable management of natural resources and the eradication of poverty. There is a clear imperative to improve the efficiency of water use in irrigated agriculture and to assess the opportunity cost of continuing such large allocations to the sector. The sector maintains a strong programme of international research and development in water use, but the economic benefit from the allocation to the sector needs to be re-evaluated in a broader, cross-sectoral perspective. To do so, key actions recommended include:

(a) At the national level:

(i) Promotion of policy reviews about the amount of water countries allocated for food production as compared to other uses, taking into consideration trade options of food in the global market;

(ii) Introduction of measures to improve the technical efficiency of agricultural water use, including close monitoring of irrigation system performance, re-use of wastewater and promotion of adaptive technological research and development;

(iii) Promotion of environmentally sound aquaculture;

(iv) Consideration of adequate policy mixes, including market incentives to reduce wastage, promote stakeholder participation and use water resources development to reduce poverty;

(v) Development of integrated approaches to water use in rainfed and irrigated agriculture;

(vi) Promotion of efficient water allocation, including charging systems for efficient water use, cost recovery policies to provide secure sustained efficient operations and maintenance of irrigation systems, taking into account the satisfaction of basic human needs and global food security.

(b) At the regional and global levels:

(i) Promotion of regional cooperation for food production and trade;

(ii) Promotion of a clearing house mechanism for sharing successful experience and technologies in the provision of water resources for food production.

4. Water for industry

36. As industrial demand grows and pressure for a modification of intersectoral allocations mounts, the need to pre-empt growth in chemical pollution will become more and more apparent. Key actions that need to be considered in regulating industrial use include:

(a) Promotion of clean technologies through information, regulation and incentives;

(b) Promotion of environmental auditing within specific industrial sectors;

(c) Formulation and implementation of economic instruments, such as pollution charges and incentives for introduction of cleaner technologies.

D. Strengthening the enabling environment

37. As stressed in the report of the 1992 International Conference on Water and the Environment, recognizing the need for a central mechanism capable of ensuring the coordination of national, social and economic interests, the role of Governments needs to be reviewed to ensure that

users, local institutions and the formal and informal private sector can play a more direct part. A key aim must be to improve accountability to the public. The levels at which management decisions can be taken and problems solved will vary widely from country to country and case to case. In any given situation, however, water resources should be managed at the lowest appropriate levels. Specific actions recommended include:

(a) At the national level:

(i) Review of existing institutional arrangements with a view to determining the existence of institutional fragmentation and to ensuring proper linkages with socio-economic decision-making processes;

(ii) Clarification of legislation concerning land and water rights, taking into account customary law;

(iii) Development of regulatory frameworks, providing an enabling environment for the effective participation of the public and private sectors.

(b) At the regional and global levels:

(i) Cooperation among international watercourse States in their harmonious development;

(ii) Promotion of regional water resources development and use strategies in the context of regional economic and social development policies and strategies.

E. Strengthening information management and promoting the penetration and flow of key data

38. A clear rationale for strengthening information management must be made. The respective technical and economic departments and government agencies may be able to start combining data sets with existing resources through regular collaborative meetings and exchanges, but need to be given clear reasons and instructions for doing so. Establishing the demand for data to justify an adequate provision of flow of financial resources may need to involve the proactive marketing of data to key decision makers. Specific actions recommended in this area include:

(a) At the national level:

(i) Assessment of existing data collection and information management systems to ensure that they meet management and decision-making requirements, are cost-effective and client-oriented;

(ii) Strengthening or development of strategic approaches to data gathering and requirements, in terms of water quantity and quality (both surface and groundwater) and water use, in relation to national, regional and local developmental and environmental objectives;

(iii) Establishment of information management systems capable of integrating, analysing and disseminating physical and socio-economic data for decision-making;

(iv) Strengthening of local capacity and participation in monitoring and assessing water resources in order to enable local people and decision makers to understand the options available for development.

(b) At the regional and global levels:

(i) Establishment of regional data, research and training centres in support of national requirements and for the monitoring and analysis of regional issues concerning the sustainable development of water resources;

(ii) Strengthening global water information networks to compile data on water quality and quantity and water use, and to support ongoing efforts in the collection and dissemination of data and information as related to integrated river basin management;

(iii) Assistance by industrialized countries, international organizations and aid agencies in the transfer of information management technology and evaluation of observational networks, and assistance in capacity-building in developing countries and economies in transition;

(iv) Periodic updating by the United Nations agencies, in cooperation with other organizations, including non-governmental organizations, of comprehensive global and regional assessments of freshwater resources.

F. Management of hydro-meteorological uncertainty

39. The need to cope with hydro-meteorological extremes and climatological shifts requires clear operational and planning guidelines based on present understanding of events and reasoned projections. The key actions that can be recommended are:

(a) At the national level:

(i) Implementation of national drought management strategies;

(ii) Formulation or updating of flood protection operational guidelines;

(iii) Formulation and execution of measures to protect the integrity of land and water ecosystems, in particular in the case of small island developing States.

(b) At the regional and global levels:

(i) Promotion of integrated basin drought and flood management strategies;

(ii) Mobilization of resources for data gathering and analysis;

(iii) Assessment of possible impacts of climate change.

G. Mainstreaming environmental concerns

40. The explicit incorporation of freshwater management in overall environmental policy is critical to maintain the stock of environmental assets and associated economic and environmental services, and should include the following set of thematic interventions.

1. Integrating land and water resources management

41. Specific actions recommended include:

(a) At the national level:

(i) Promotion of integrated land and water management within the framework of national development plans, and study the linkages between regional economic development programmes and integrated river basin management;

(ii) Control of the use of fertilizers and pesticides to minimize non-point pollution sources and promote integrated pest management through appropriate regulatory and economic instruments.

(b) At the regional and global levels:

(i) Development of river basin action plans, especially for high-priority risk basins, including their rivers, lakes and aquifers, to integrate land-use planning, especially in upstream regions, with water management and conservation; coordinate the activities of provincial, national and international agencies; and address transboundary issues;

(ii) Support for the implementation of the United Nations Convention to Combat Desertification, in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa; the Convention on Biological Diversity; and the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention).

2. Protecting water quality and preventing water pollution

42. Specific actions recommended include:

(a) At the national level:

(i) Promotion of economic mechanisms based upon the polluter-pays principle;

(ii) Strengthening or promotion of local participation in pollution control efforts;

(iii) Formulation and implementation of basin action plans to address transboundary pollution issues and to initiate contingency plans to control accidental spills;

(iv) Promotion of integrated approach to quantity and quality components of water resources management;

(v) Integration of land-use management and sustainable water management.

(b) At the regional and global levels:

(i) Establishment of links to the recommendations of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities;

(ii) Recognition of freshwater, coastal and marine environments as a management continuum;

(iii) Implementation of actions to protect upstream areas (mountains and forests) in order to preserve water quality downstream, recognizing the important link between land management and water quality.

3. Incorporating freshwater management in overall ecosystem protection and management

43. Specific actions recommended include:

(a) At the national level:

(i) Promotion of national environmental valuation and accounting;

(ii) Assessment of the water requirements of natural systems, including wetlands, to maintain integrity for sustained productivity;

(iii) Formulation of strategic action plans for the protection and management of aquatic ecosystems, within the framework of the conventions on biological diversity and desertification, the Ramsar Convention and the Global Environment Fund operational programmes;

(iv) Promotion of local involvement in efforts to protect ecosystems.

(b) At the global and regional levels:

(i) Strengthening of regional cooperation in efforts to protect ecosystems of transboundary rivers, lakes and wetlands;

(ii) International cooperation to promote water conservation and recycling, pollution prevention and control, and environmentally sound agricultural and industrial practices.

H. Financing water supply and sanitation to meet basic human needs and wastewater treatment

44. It is clear that the overall level of current investment in water infrastructure is insufficient to meet basic human needs and acceptable levels of socio-economic development. As mentioned above, the current rate of expenditure in water supply and sanitation is estimated to be only a third of the amount required to achieve full coverage. While official development assistance (ODA) is an important source of water sector finance in the poorest countries, in most developing countries the bulk of investments required to develop, upgrade or maintain water resources infrastructure will have to come from national sources. In order for that to happen Governments need to foster an enabling environment that encourages investments from both public and private sources, and to formulate and implement pricing policies for greater cost recovery, efficient allocation of water and water conservation, taking into account the country's level of development. In addition, Governments need to allocate a significantly higher proportion of their budget expenditures to public investments in water supply and sanitation with a view to increasing the rate of coverage considerably. That is particularly true in the case of sanitation (and sewage treatment), which is not only lagging behind water supply coverage but also has more limited opportunities for cost recovery.

45. Nonetheless, given the insufficient rate of investment in water-related infrastructure in developing countries, and as clearly stated in the Programme for the Further Implementation of Agenda 21 (see General Assembly resolution S-19/2, annex), ODA remains an important source of external funding for many developing countries, particularly the least developed countries. It can thus be considered as essential for the effective implementation of Agenda 21 since it cannot always be replaced by private capital flows. ODA can play an important complementary and catalytic role in promoting economic growth, and may in some cases play a catalytic role in encouraging private investment and – where appropriate – all aspects of country-driven capacity-building and strengthening.

46. The 20/20 initiative agreed upon at the World Summit for Social Development at Copenhagen called for an agreement on a mutual commitment between interested industrialized and developing country partners to allocate, on average, 20 per cent of ODA and 20 per cent of the national budget, respectively, to basic social services, including water supply and sanitation. Current United Nations Children's Fund estimates suggests that developing countries, on average, are spending only about 13 per cent of government budgets on basic social services, and that about 10 per cent of ODA is spent on basic social services. There are many opportunities for innovative financing arrangements for water development, with risks spread among a broader range of beneficiaries and stakeholders. A move towards full cost recovery by guaranteeing the commercial and managerial autonomy of water services is one essential element of financially sustainability. The key actions in that process are:

(a) At the national level:

(i) Identification of all potential actors at local and regional levels to ensure that all possible sources of expertise and finance can be tapped;

(ii) Strengthening of the role of the Government at various levels, as a provider of development financing for specific development projects and as a provider or guarantor of credits to public and private ventures;

(iii) Development of criteria and approaches to pricing policies related to the provision of water resources and demand management, taking into account basic human needs, cost recovery requirements, allocation efficiency, internalization of environmental costs and benefits, and other socio-economic considerations;

(iv) Development of public-private partnerships to improve efficiency of water provision and to tap private investments for the expansion or improvement of water infrastructure.

(b) At the regional and global levels:

(i) Fulfilment by industrialized countries of their commitments to reach the accepted United Nations target of 0.7 per cent of gross national product as soon as possible;

(ii) Formulation of regional financing strategies, involving regional financial organizations in partnership with other international organizations and the private sector;

(iii) Coordination of international financial resource flows in the form of direct grants and loans in concessional terms to developing countries, in particular the least developed countries, in addition to the mobilization of the private sector.

47. Mobilizing finance for wastewater treatment can be initiated not only through punitive environmental and public health regulation but also through the imaginative use of information exchange and partnering with communities, municipalities and industry. New low-cost techniques for small-scale sewerage and treatment are currently available, including the use of pond systems. For industry, net savings may be possible if relatively small investments are made in clean technologies. In water-scarce regions, municipalities may be able to enter into wastewater reuse profitably if pricing policies reflect long-run marginal costs.

I. Starting a process of nationally owned diagnosis and obtaining consensus and commitment

48. A compelling case for the integration of water management into the national development process and cross-sectoral programme formulation must be made at a high level and endorsed at all levels. The first step for such an initiative may be a diagnostic assessment of current physical and socio-economic circumstances surrounding water, predictions of trends in consumption patterns and the formulation of feasible solutions. Such a start needs to be nationally owned and internalized if it is to lead to sustained national commitment to change and reform. External support from specialized United Nations agencies, multilateral agencies, bilateral agencies and international non-governmental organizations can be sought when they are able to support the process financially and offer specific advice and peer review in their areas of comparative advantage.

J. Build balanced and sustainable capacity in water management

49. The water managers of the future will have to be much more multidisciplinary to cope with new policy agendas and operational procedures. Not only the traditional hydrologists and hydraulic engineers but also biologists, accountants, environmentalists, economists and social scientists will all have important roles to play in advancing sustainable freshwater management. Key steps in building such capacity are:

(a) Assessment of present and future national capacities in the above broad range of disciplines, and specification of future training needs;

(b) Implementation of a long-term training programme to keep a critical stock of human resources in place;

(c) Establishment of human resources management programmes for enhancing employment opportunities and remunerating water management professionals in line with other sector professionals.

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Activities of the organizations of the United Nations system in the field of freshwater resources

Report of the Secretary-General

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I. Introduction

1. The present report has been prepared pursuant to Economic and Social Council agreed conclusions 1997/3, by which the Council urged the ACC Subcommittee on Water Resources[1] to analyse in detail the activities that are currently being carried out by the organizations of the United Nations system in the field of freshwater resources, and the interrelationship between them, and requested the Secretary-General to prepare a report by the end of 1997, as an input into the preparatory process leading up to the sixth session of the Commission on Sustainable Development.

2. Section I summarizes both the involvement of and cooperative arrangements among the organizations of the system. Section II focuses on strategic responses of the United Nations system to challenges faced by Governments and the international community in striving towards the sustainable development and utilization of water resources. A comprehensive review of cooperative arrangements among organizations of the system in the field of water resources was provided in the report of the Secretary-General on freshwater, including clean and safe water supply and sanitation (E/1997/70),which was submitted to the Economic and Social Council at the coordination segment of its substantive session of 1997.

II. Nature and interrelationship of the activities of the organizations of the United Nations system in the field of water resources

3. The activities of the organizations of the United Nations system in the field of water resources are wide-ranging in scope and nature. Table 1 describes the involvement of organizations in specific aspects of water resources assessment, development and management, based on the programme areas of chapter 18 of Agenda 21. The three main natures of activity are (a) data gathering/analysis and preparation of studies and reports, (b) organization and servicing of meetings and workshops and (c) technical cooperation, including advisory services and field projects. Table 2 lists current cooperative arrangements among organizations of the system.

A. Water for socio-economic development

1. Integrated water resources management

4. The Department for Economic and Social Affairs of the United Nations Secretariat provides support to the General Assembly, the Economic and Social Council, the Commission on Sustainable Development, the Committee on Natural Resources and the ACC Subcommittee on Water Resources. The Department functions as the secretariat for the ACC Subcommittee. The Department assists many countries in their efforts to translate the internationally adopted water-related programme of Agenda 21 into country-specific programmes and projects in the context of both the holistic management of water and the integration of water sector plans and programmes into the framework of national, economic and social development plans.

5. United Nations Environment Programme (UNEP) activities include assistance to Governments in the development of integrated river basin management plans for sustainable water use through its programme on the environmentally sound management of inland waters, and through basin diagnostic studies and action programmes for international river and lake basins. As Chair of the Water Working Group of the United Nations System-wide Special Initiative on Africa, UNEP is working to coordinate United Nations agency efforts to achieve specific social, economic and environmental goals in the sustainable use of freshwater resources in the region.

6. United Nations University (UNU) activities in this area focus on river basin governance and the development of new water management tools, which includes preparing detailed assessments of sustainable management challenges in international river basins. The Food and Agriculture Organization of the United Nations (FAO) is involved in the implementation of a number of field projects on integrated watershed management throughout the world, many of which include a focus on achieving environmental stability to protect fresh water resources and satisfy the demand in both upland and lowland areas. United Nations Educational, Scientific and Cultural Organization (UNESCO) activities focus on the organization or facilitation of meetings, conferences and workshops, including a recent international conference on risk, reliability, uncertainty and robustness of water resources systems, a workshop on negotiations on water in areas of conflict and an envisaged regional workshop on international river basins. The United Nations Development Programme (UNDP) funds many projects on integrated water resources development and management in

Table 1
Involvement of organizations of the United Nations system in the field of water resources, by strategic management function and nature of activity

Strategic management functions	*Data gathering, analysis and studies*	*Organization and servicing of meetings*	*Technical cooperation*
A. Water for socio-economic development			
Integrated water resources management	DESA, ECA, ECE, ECLAC, ESCAP, ESCWA, UNDP, UNEP, UNU, INSTRAW, FAO, UNESCO, World Bank	DESA, ECE, ECLAC, ESCAP, ESCWA, UNU, FAO, UNESCO	DESA, ECE, ECLAC, ESCAP, ESCWA, UNDP, UNEP, UNU, FAO, World Bank
Water for sustainable food production and rural development	ECA, ESCAP, ESCWA, UNEP, FAO, WHO, World Bank	ESCAP, UNEP, FAO	DESA, ECA, ESCWA, UNDP, UNHCR, FAO
Water supply and sanitation	DESA, ECE, ECLAC, ESCAP, UNICEF, UNDP, UNEP, Habitat, UNHCR, UNU, INSTRAW, WHO, World Bank	DESA, ESCAP, ECE, World Bank, UNU, INSTRAW, Habitat, UNICEF, WHO	DESA, ESCAP, ESCWA, UNU, INSTRAW, Habitat, UNICEF, UNDP, UNHCR, FAO, WHO, World Bank
Water for sustainable urban development	ESCAP, UNDP, UNEP, Habitat, UNESCO, WHO, WMO, World Bank	ESCAP, UNDP, Habitat, UNESCO, WMO	ESCAP, UNICEF, UNEP, Habitat, FAO, UNESCO, WMO
Industrial water use	ESCWA, UNEP, UNU, UNIDO, IAEA	UNIDO, IAEA	ECLAC, ESCWA, UNU, UNIDO, IAEA
In-stream uses of water resources	ECA, ESCAP, UNEP, World Bank	ESCAP, UNEP, World Bank	DESA, ESCAP, UNDP, UNEP, World Bank, UNIDO
Mitigation of water-related natural disasters	ESCAP, IDNDR, FAO, UNESCO, WMO	ESCAP, IDNDR, UNESCO, WMO	DESA, ESCAP, IDNDR, UNDP, FAO, UNESCO, World Bank, WMO
B. Health and productivity of the aquatic environment	DESA, ECE, ECLAC, ESCAP, ESCWA, CBD, UNFCCC, UNDP, UNEP, UNU, FAO, UNESCO, WHO, World Bank, UNIDO	ECE, ESCAP, CBD, UNFCCC, UNEP, UNU, UNESCO	DESA, ECE, ESCAP, ESCWA, UNDP, UNEP, Habitat, UNU, FAO, UNIDO, WHO, World Bank
C. Information management	DESA, ECA, ESCAP, ESCWA, FAO, IAEA, World Bank, UNICEF, UNESCO, UNEP, UNU, WHO, WMO	ESCAP, ESCWA, UNICEF, UNESCO, UNU, WHO, WMO, UNEP	DESA, ESCAP, ESCWA, FAO, IAEA, World Bank, UNICEF, UNDP, UNESCO, UNEP, UNU, WHO, WMO
D. Financial assistance	ECA, ESCWA, ESCAP, UNICEF, UNDP, UNEP, UNU, UNESCO, WHO, World Bank, WMO, IAEA	DESA, ECA, ECE, ECLAC, ESCAP, ESCWA, UNICEF, UNDP, UNEP, Habitat, INSTRAW, IDNDR, UNU, FAO, UNESCO, WHO, World Bank, WMO, UNIDO	Habitat, UNICEF, UNDP, UNU, FAO, UNESCO, WHO, World Bank, WMO, UNIDO, IAEA
E. Capacity-building	ECLAC, ESCAP, ESCWA, UNICEF, UNDP, UNEP, UNU, INSTRAW, UNESCO, WHO, WMO, IAEA	ESCAP, ESCWA, UNICEF, UNDP, UNEP, UNU, INSTRAW, UNESCO, WHO, WMO, IAEA	DESA, ECLAC, ESCAP, ESCWA, UNICEF, UNDP, UNEP, Habitat, UNU, INSTRAW, IDNDR, FAO, UNESCO, WHO, World Bank, WMO, UNIDO, IAEA

Table 2
Current cooperative arrangements among organizations of the United Nations system in the field of water resources, by strategic management function

Strategic management functions	*Major cooperative arrangements (as per report of the Secretary-General on freshwater, including clean and safe water supply and sanitation: Report of the ACC Subcommittee on Water Resources on its eighteenth session and inputs to this report)*
Integrated water resources management	• ACC Subcommittee on Water Resources: DESA, ECA, ECE, ECLAC, ESCAP, ESCWA, UNICEF, UNDP, UNEP, Habitat, UNHCR, UNU, INSTRAW, CBD, CCD, UNFCCC, IDNDR, FAO, UNESCO, WHO, World Bank, WMO, UNIDO and IAEA • ACC Subcommittee Working Group on Integrated Approaches to Land and Water Management: DESA, FAO, IAEA, UNICEF, ESCAP, UNESCO, UNEP and WHO • Joint Programme on Integrated Land and Water Management: FAO and UNESCO • Interagency Committee on Water Resources in Africa: ECA and several other ACC Subcommittee members • Interagency Committee on Water Resources in Asia and the Pacific: ESCAP and several other ACC Subcommittee members
Water for sustainable food production and rural development	• Effective Planning and Management of Irrigated Agriculture: FAO, UNEP and WMO • Technical Consultation on Sustainable Agriculture and Rural Water Management: FAO, World Bank, UNICEF, UNDP and WHO
Water supply and sanitation	• Cooperation and Coordination Mechanisms in Water Supply and Sanitation: Habitat, UNICEF and UNDP • Interagency Steering Committee on Water Supply and Sanitation: DESA, FAO, IAEA, World Bank, INSTRAW, Habitat, UNICEF, UNDP, ECA, ESCAP, ECE, ECLAC, ESCWA, UNESCO, UNEP, UNHCR, UNIDO, UNU, WHO and WMO • Joint Activities towards Universal Access to Water Supply and Sanitation in Asia and the Pacific: DESA, World Bank, INSTRAW, UNICEF, UNDP, ESCAP and WHO • Joint Initiative on Participatory Methods for Hygiene Behaviour Change and Sanitation: World Bank, UNICEF, UNDP, WHO • Joint Initiative on Prevention and Control of Water-related Diseases in Europe: ECE, UNEP and WHO • Joint Monitoring Programme (JMP) for Water Supply and Sanitation: UNICEF and WHO • Memorandum of Understanding on Water and Environmental Sanitation: World Bank and UNICEF • Promotion of Sustainable Water Supply and Sanitation Programme: World Bank, UNDP and WHO • Water Supply and Sanitation Programme: World Bank and UNDP • Water Supply and Sanitation Programme in Rural Areas: DESA, UNDP and UNCDF (United Nations Capital Development Fund) • Water Working Group of the System-wide Special Initiative on Africa: DESA, FAO, IAEA, World Bank, Habitat, UNICEF, UNDP, ECA, UNESCO, UNEP, UNIDO, WHO and WMO
Water for sustainable urban development	• Collaboration on Urban Sanitation Technologies: Habitat and UNICEF • Urban Hydrology Cooperation Project: UNESCO and WMO
Industrial water use	• Collaboration on Industrial Pollution Prevention and Abatement Guidelines: UNEP, WHO, World Bank and UNIDO
In-stream uses of water resources	• Global Research Initiative on Ecohydrology: UNDP and UNESCO
Mitigation of water-related natural disasters	• Implementation of the International Decade for Natural Disaster Reduction: IDNDR and WMO • Typhoon Committee and Panel on Tropical Cyclones: ESCAP and WMO • World Climate Programme/Water: UNESCO and WMO

Strategic management functions	*Major cooperative arrangements (as per report of the Secretary-General on freshwater, including clean and safe water supply and sanitation, Report of the ACC Subcommittee on Water Resources on its eighteenth session and inputs to this report)*
Health and productivity of the aquatic environment	• ACC Subcommittee Steering Committee for Implementation of the GPA: DESA, FAO, UNESCO, UNEP, UNU, WHO and WMO • ACC Subcommittee Water Quality Initiative: DESA, UNESCO, UNEP, UNU and WHO • Global Freshwater Quality Monitoring Programme (GEMS)/Water: ECE, UNESCO, UNEP, WHO and WMO • Panel of Experts on Environmental Management for Vector Control (PEEM) FAO, Habitat, UNEP and WHO
Information management	• ACC Subcommittee Internet Modernization Project: DESA, UNU and other ACC Subcommittee member agencies • African Water Resources Assessment Strategy: ECA and WMO • Global Information Network on Activities of the United Nations System in the Field of Water Resources: DESA, UNU and other ACC Subcommittee member agencies • Inter-agency Working Agreement on Water Resources Assessment: UNESCO and WMO • Joint Project on GIS Application to Water Resources: FAO and UNESCO • Water and Sanitation Monitoring System (WASAMS): UNICEF and WHO • World Hydrological Cycle Observing System (WHYCOS): World Bank and WMO
Financial assistance	• [most cooperative arrangements mentioned in this table involve some financial assistance]
Capacity-building	• 1998 World Water Day Celebration: DESA, UNICEF and other ACC Subcommittee member agencies • Joint Initiative on School Water Supply, Sanitation Hygiene Education: UNICEF and WHO • Women, Water Supply and Sanitation Training Package: DESA, INSTRAW, ILO, UNDP, ESCAP and UNICEF

all developing country regions. The World Bank also provides loans and technical assistance to dozens of ongoing projects in the area of natural resources management in many developing countries.

7. With regard to the regional commissions, the Economic Commission for Africa (ECA) focuses on the production of technical documents on options for integrated water resources management in selected African countries. The Economic and Social Commission for Asia and the Pacific (ESCAP) has been responsible for several workshops and seminars, publications and advisory missions to countries in the region, especially in the area of integrated river basin planning. The Economic Commission for Europe (ECE) activities focus mainly on support for the implementation of the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes, including providing assistance to countries with economies in transition for the protection and management of transboundary waters, integrated management of water and related ecosystems, and land-based pollution control. The Economic Commission for Latin America and the Caribbean (ECLAC) focuses on promoting policies for establishing or strengthening institutions at the river basin level and on assistance in the field of water law. The Economic and Social Commission for Western Asia (ESCWA) has organized several expert group meetings and provided advisory services to its member States, particularly in the areas of optimal utilization of shared water resources, water legislation and the impact of water pricing on water demand.

2. Water for sustainable food production and rural development

8. FAO is currently responsible for about 100 technical cooperation projects in the area of water for food production and rural development. Because of the dominant role of agricultural water use in many regions of the world, such projects bear a strong relationship to the integrated management of water resources. Its International Action Programme on Water and Sustainable Agricultural Development incorporates broad reviews of national water sectors, including river basin master planning, management issues and environmental sustainability, and is the major FAO instrument for assisting United Nations Member States in implementing water policies for sustainable agricultural development and management, as defined in chapter 18 of Agenda 21. The FAO Special Programme for Food Security is designed to enhance the food production capacity of low-

income food-deficit countries; the water sector of this programme aims to provide assistance to Governments in expanding low-cost, medium-scale and small-scale irrigation. FAO promotes water-harvesting techniques in arid and semi-arid areas in order to alleviate water shortages associated with supplementary irrigation techniques in crop production. It also executes many field projects on the use of marginal quality waters, such as saline drainage water and municipal or industrial wastewater, and promotes the transfer of small-scale irrigation technologies for peri-urban areas in developing countries.

9. The World Bank provides loans and technical assistance to irrigation and drainage projects in developing countries and those with economies in transition. UNDP also funds several ongoing projects on improving water resources management for agricultural use. UNDP, the World Bank, FAO and the International Commission for Irrigation and Drainage are the co-sponsors of the International Programme for Technology Research in Irrigation and Drainage, which assists countries in the identification of critical research and development gaps, the formulation of research and development projects and the mobilization of donor support. The Office of the United Nations High Commissioner for Refugees (UNHCR) operational activities include the development of emergency water facilities to meet the agricultural requirements of refugee communities in such a way that the level of technology and long-term operation and maintenance are compatible with the capacity of the beneficiary communities.

10. ECA is currently preparing a major technical document on fisheries as a contribution to food security in Africa. ESCAP recently held two workshops on irrigation water supply and on pricing policies for urban and rural water supply, both of which resulted in the subsequent publication of technical documents. ESCWA is currently carrying out a study on the development of non-conventional sources of freshwater resources in rural areas, including desalination, wastewater reuse, use of marginal water and water harvesting, and a comprehensive regional evaluation of progress in the implementation of chapter 18 of Agenda 21, with particular emphasis on sustainable agricultural production.

3. Water supply and sanitation

11. As secretariat of the Inter-Agency Steering Committee on Water Supply and Sanitation, the World Health Organization (WHO) acts as a focal point in the United Nations system for fostering cooperation in this programme area. Its water supply and sanitation activities, both in terms of studies and field projects, focus primarily on human settlements, basic services, health, water quality and behavioural change. The WHO Drinking-Water Quality Guidelines are promoted through regional workshops and country consultations, while surveillance of drinking water is supported with training and provision of analytical tools. The WHO country-based Africa 2000 initiative aims to accelerate investment in water supply and sanitation in the region by means of a new partnership between countries and the external development community.

12. The United Nations Children's Fund (UNICEF) has also historically played a leading role in this area, in particular by supporting the capacity-building of Governments and communities in over 100 countries in their efforts to increase the coverage of access to safe drinking water and environmental sanitation, with a focus on the rights of the child to a safe environment, safe water and sanitation for survival, and the protection and development of children and their mothers. UNICEF has often used this intervention to mainstream gender issues and promote the empowerment of women by supporting a project for women hand pump caretakers, women-managed water committees, sanitation programmes and micro-credit schemes for income generation, often in close cooperation with the International Research and Training Institute for the Advancement of Women (INSTRAW) and other institutions. The UNICEF Strategy on Water and Environmental Sanitation stresses the need for greater attention to environmental sanitation, hygiene promotion, development and field testing of the low cost appropriate technologies for water supply and sanitation, operation and maintenance centred on vulnerable groups, including the urban poor, and capacity-building of private entrepreneurship through training and technology transfer in the production and marketing of hand pumps, drilling rigs and other water technologies.

13. UNDP and the World Bank both provide substantial funds and technical assistance to developing countries and economies in transition for projects in both urban and rural areas. The UNDP/World Bank Water and Sanitation Programme promotes investments in the water and sanitation sector by supporting communities and Governments through capacity-building, enhancing the involvement of stakeholders in the selection, operation and maintenance of systems, and fostering the involvement of the private sector, non-governmental organizations and user groups.

14. The Department of Economic and Social Affairs of the United Nations Secretariat, in collaboration with UNDP and the United Nations Capital Development Fund, has been involved in cooperative efforts to assist developing countries, particularly least developed countries, in the

management of water supply and sanitation programmes in rural areas. These programmes are usually linked to national programmes for poverty eradication, income generation, enhancing the role of women in economic and social development, and other developmental efforts. The United Nations Centre for Human Settlements (Habitat), in collaboration with UNICEF, as well as with a number of other organizations outside the United Nations system, promotes the development and use of urban sanitation technologies to expand access to water supply and sanitation services for the urban poor. UNHCR water-sector activities aim to foster a preventive health approach in favour of the beneficiaries of refugee assistance programmes throughout the world. INSTRAW is the major advocate for the role of women in water supply and sanitation within the United Nations system, and in that capacity has prepared policy statements for various intergovernmental meetings, produced two multi-media training packages on women, water supply and sanitation, and conducted national, subregional and regional training seminars in cooperation with the Department of Economic and Social Affairs, UNICEF, UNDP and ESCAP. FAO activities in this field are limited to interventions within integrated rural development initiatives.

15. ESCAP activities in this area focus on the mobilization of community participation and resources to contribute to providing universal access to water supply and sanitation. These activities have been carried out mostly in collaboration with other United Nations agencies, particularly the Department of Economic and Social Affairs, INSTRAW, UNICEF, WHO, UNDP and the World Bank. Activities in this area have included the organization of workshops and seminars in the region, in particular four national workshops on the use of the training modules of the above-mentioned training package on women, water supply and sanitation. ECE focuses mainly on support for the implementation of the water supply and human health objectives of the above-mentioned Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Together with WHO, UNEP and the European Commission, ECE is preparing an international instrument on the prevention, control and reduction of water-related diseases, to be presented to the 1999 London Ministerial Conference on Environment and Health. ECLAC activities in this area focus on private participation in water supply and sanitation and its regulation, including the provision of advice to countries of the region. ESCWA activities in this area focus on providing advisory services to member States, such as, advice to Qatar on the management of drinking water in rural areas.

4. Water for sustainable urban development

16. The United Nations Conference on Human Settlements (Habitat II) preparatory process included an international conference on managing water resources for large cities and towns, held at Beijing in March 1996 and organized by Habitat, in cooperation with the Department of Economic and Social Affairs, UNEP and other United Nations bodies. The declaration adopted by the Conference focused on the urgency of undertaking greater efforts to promote management for improving the efficiency of water use, as well as the importance of innovative financing mechanisms and broad-based partnerships bringing together the public and private sectors and local communities. As the first major follow-up to Habitat II, Habitat and UNDP, in collaboration with major African non-governmental organizations organized an international consultation on partnerships in the water sector for cities in Africa, held at Cape Town, South Africa, in December 1997. The consultation addressed the need for a broad-based partnership approach to meet the rapidly growing water demand in African cities. As the focal point for this programme area within the United Nations system, Habitat is also involved in other initiatives, such as a project on the integrated management of urban water resources by promoting partnerships among local authorities, the private sector, non-governmental organizations and community user associations.

17. Activities by other organizations include World Meteorological Organization (WMO) and UNESCO initiatives on urban hydrology; the UNEP promotion of environmental impact assessments of human water use in peri-urban areas and of environmental technologies focusing on the water needs of urban areas; and the ESCAP organization of several workshops and undertaking of many advisory missions to improve urban water resources management. Both UNDP and the World Bank fund several projects with components focusing on sustainable urban water resources development and management.

5. Industrial water use

18. Current United Nations Industrial Development Organization (UNIDO) programmes and projects focus on the design and application of infrastructure for industrial water use and water treatment in industrial processes; improving efficiency of industrial water use, including recycling and conservation; and industrial effluent reduction.

UNIDO acts as a clearing house for information on industrial water use, and provides assistance in the manufacture of water supply and treatment equipment. UNEP is currently working on the development of a benchmark publication on environment, water and sustainable development that includes a review of industrial water use. IAEA activities in this area focus on the efficient utilization of water for cooling purposes in the nuclear industry, and on the use of nuclear energy for the desalination of sea water. ECLAC activities are related to environmental management in the mining industry.

6. In-stream uses of water resources

19. Both UNDP and the World Bank have funded several projects involving specific in-stream uses of water resources, in particular hydroelectric dams, in recent years. A workshop on the future of large dams jointly hosted by the World Bank and the World Conservation Union, held at Gland, Switzerland, in April 1997, brought together leading experts and major stakeholder representatives from Governments, civil society, international organizations and the private sector. As an outcome of the workshop, a two-year world commission on dams is being set up to assess the experience of large dams and evaluate their development effectiveness; develop decision-making criteria, policy and regulatory frameworks for assessing alternatives to energy and water resources development; develop internationally accepted standards for large dams, including the promotion of best practices; and identify the implications for institutional, policy and financial arrangements so that benefits, costs and risks are equitably shared at the global, national and local levels.

20. The Department of Economic and Social Affairs provided support for a small-scale hydropower project. ECA is undertaking a study of the economic viability of manufacturing turbines and generators for mini-hydro projects in Africa. ESCAP is implementing a programme for Asian cooperation on energy and the environment, which includes a management component focusing on private sector participation in hydropower generation and its consequences on environmental quality. UNIDO works with energy ministries, utilities and private energy companies to raise awareness of new and innovative ways of financing more efficient power-generating capacity, including several hydropower projects worldwide.

7. Mitigation of water-related natural disasters

21. The secretariat of the International Decade for Natural Disaster Reduction (IDNDR) is involved in the implementation of its risk assessment tools for diagnosis of urban areas against seismic disaster projects. The secretariat also runs annual public awareness-raising campaigns; the theme in 1997 was "Water: too much, too little ... leading cause of natural disasters". It also implements pilot activities to reduce risk of water-related natural disasters in selected small island States, and as a task force on floods in Central and Eastern Europe. The secretariat works closely with WMO to ensure that the General Assembly and other intergovernmental bodies are appraised of the importance of establishing and maintaining appropriate and cost-effective early warning systems. The findings of two reports on the improvement of early-warning capacities submitted to the General Assembly in 1995 and 1997 will form the basis for the International Conference on Early-Warning for Natural Disasters, to be held at Potsdam, Germany, in 1998.

22. As part of its basic mission, WMO coordinates national activities for monitoring and forecasting floods and droughts. WMO works with UNESCO on water-related aspects of the World Climate Programme, including the planning of the Second International Conference on Climate and Water, to be held in Finland in August 1998. As part of activities related to integrated water resources management in arid and semi-arid zones, UNESCO is implementing a project entitled "Coping with water scarcity", and is organizing an international conference on drought management, to be held in South Africa in 1998. Under the aegis of a project entitled "Non-structural flood control measures to balance risk-cost-benefit in flood control management in urban areas", UNESCO plans to develop a real-time urban flood management decision support system in a pilot basin within the São Paulo, Brazil, metropolitan area, and to hold a workshop on non-structural flood control in urban areas, also at São Paulo, in April 1998. A document entitled, "Impacts of climate change and climate variability on hydrological regimes" will soon be published as part of the UNESCO International Hydrology Series.

23. The Department of Economic and Social Affairs has been involved in activities related to integrated flood and typhoon management for small islands and in projects dealing with the mitigation of extreme meteorological events in the South Pacific and the Persian Gulf. ESCAP work on natural disaster reduction includes the organization of a major regional workshop, held at Bangkok in March 1997, on appropriate land-use planning and watershed management to reduce damage owing to water-related disasters; the publication of a detailed study entitled "Natural hazards and

natural disaster reduction in Asia and the Pacific"; the annual celebration of IDNDR Day in the region; and the provision of advisory services to countries on water-related natural disasters. In cooperation with WMO, ESCAP continues to support the efforts of the Typhoon Committee and the Panel on Tropical Cyclones. FAO assists several countries in the establishment of flood protection and management systems. The World Bank provides loans and technical assistance to many projects throughout the developing world, particularly in the area of flood protection. UNDP also funds several projects is this area, including two programmes to save the Aral Sea and two projects on drought prevention in Ethiopia.

B. Health and productivity of the aquatic environment and impact on human health of the degradation of water resources

24. The water quality monitoring programme of the Global Environment Monitoring System (GEMS/Water), co-sponsored by WHO, UNEP, WMO and UNESCO, constitutes the major United Nations system for water quality monitoring. Global and regional assessments on water quality have been carried out, including on ground water quality in Asia and the Pacific and on water quality problems in the former USSR. A global register of rivers flowing into the oceans has also been established to provide pollutant fluxes for more than 400 rivers worldwide. Institutional support for GEMS/Water data gathering and analysis is provided by the Global Water Quality Data Centre and the Global Runoff Data Centre, located in Canada and Germany, respectively.

25. UNEP, as secretariat of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, facilitates the implementation of the water quality components of the programme. The Department of Economic and Social Affairs is collaborating with government organizations to enhance national capacity to address the problem of water pollution, by establishing control measures for major industries and commercial enterprises, encouraging the reuse and recycling of wastewaters, and improving agricultural practices. The World Bank provides significant loans to projects dealing with environmental protection of freshwater resources. UNDP also funds many ongoing projects in this programme area, including three separate projects on reversing environmental degradation in the Aral Sea and an emergency water hyacinth reduction programme on Lake Victoria. UNU has several activities dealing with water monitoring, including the Asia-Pacific Mussel Watch programme. UNIDO activities to prevent and control land-based sources of industrial pollution include the implementation of a major project aimed to protect and restore the health of the large marine ecosystem of five countries in the Gulf of Guinea.

26. The UNESCO International Hydrological Programme is currently implementing two projects, entitled "Interactions between river systems, flood plains and wetlands" and "Comprehensive assessment of surficial ecohydrological processes". Its project on land/inland water ecotones also published two major documents on freshwater biodiversity. The biological diversity of inland water ecosystems was actually the thematic focus of the third meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity, held in September 1997, which put forward recommendations for a work programme on inland water biological diversity. With the legally binding commitments that it contains, the Convention aims to ensure sustainable maintenance of biological diversity, including aquatic biological diversity, thereby contributing to the health and productivity of the aquatic environment. FAO, through its various activities, aims to ensure appropriate water quality for optimum crop, fish and animal production, to enable the safe use and disposal of municipal wastewater in agriculture, and to protect downstream water sources from non-point sources of pollution from agricultural activities. It also conducts activities concerning wetland management and the control of waterlogging and salinization in irrigated lands. FAO and UNESCO are jointly responsible for the implementation of an integrated land and water management programme aimed to prevent the pollution of groundwater due to agricultural practices.

27. The disease control and eradication programmes of WHO, notably its programmes for diarrhoeal diseases, guinea worm, schistosomiasis and river blindness, as well as the joint WHO/FAO/UNEP/Habitat Panel of Experts on Environmental Management for Vector Control (PEEM), have had a significant impact on the way in which water resources are being managed in many countries. PEEM is collaborating with the World Conservation Union in a project on conservation and resource utilization in selected wetlands of the Zambezi River basin, and is actively involved in the promotion of environmental management for vector control in dams and reservoirs for hydropower generation. In collaboration with the London School of Hygiene and Tropical Medicine and the United Kingdom Overseas Development Institute, PEEM is producing guidelines on urban environmental management for disease

vector control, and is promoting disease vector control through agricultural extension programmes.

28. The Global Environment Sanitation Initiative, as endorsed by the Fourth Global Forum of the Water Supply and Sanitation Collaborative Council, held at Manila from 3 to 7 November 1997, in which ACC Subcommittee members are taking a leading role, is another good example of system-wide action to improve the current situation in the area of environmental sanitation.

29. ESCAP activities in this area include the organization of an expert group meeting on the protection of water resources, water quality and aquatic ecosystems, a workshop on water-related problems in low-lying coastal areas, the publication of a document entitled "Protection of water Resources, water quality and aquatic ecosystems in Asia and the Pacific", and several advisory missions. ECE involvement in the implementation of the 1992 Convention on the Protection and Use on Transboundary Watercourses and International Lakes also includes several activities related to protection of water resources. ECLAC activities centre on the formulation of alternative instruments for the management of water quality in freshwater bodies, and on coastal and estuarine areas. ESCWA activities include studies on water quality and water pollution in selected urban areas, and on the harmonization of environmental standards in the water sector of its member States, as well as the provision of advisory services in support of sustainable water resources management.

C. Information management

30. WMO has taken the lead in efforts to improve the capacity of national and regional water resources assessment services, through programmes like the World Hydrological Cycle Observing System. That initiative is already under way in Mediterranean countries and southern Africa, with the support of the World Bank and other organizations outside the United Nations system, and plans are well advanced in other regions. Related activities include the implementation of the African Water Resources Assessment Strategy adopted by the African Conference on Water Resources, which was convened jointly by WMO and ECA at Addis Ababa in March 1995. WMO is also responsible for several other activities designed to improve water resources assessment and establish networks of hydrological observation stations for monitoring the quality and quantity of both surface and groundwater, including substantial support for the operation of the Global Runoff Data Centre at Koblenz, Germany. UNESCO activities in this area include a project to support international efforts to collect and process hydrological data; several initiatives on urban hydrology, such as two projects on surface and groundwater management in the urban environment and on integrated urban drainage modelling in different climates; and a joint project with FAO on the application of geographical information systems to water resources. In addition to this joint activity, FAO continues to develop its statistical global database on rural water use and irrigation, and has also developed manuals and guidelines to estimate peak floods and annual runoff of small river basins in Africa where no hydrological data exist. UNDP funds several projects is this area, including the Sub-Saharan Africa Hydrological Assessment, in cooperation with the World Bank, a water resources information project in Bangladesh and a groundwater data bank in the Philippines.

31. Through its activities concerning the integrated management of water resources, the Department of Economic and Social Affairs provides policy advice to developing countries for information management. Modern computer technologies and up-to-date groundwater software have been introduced and promoted in many developing countries. The water supply and sanitation Joint Monitoring Programme, established by WHO and UNICEF, is primarily aimed at the development of national capacities for sector monitoring, and as a secondary objective at the preparation of national and international assessments. IAEA technical cooperation programme in isotope hydrology covers a broad spectrum of fields, including applications related to hydrogeological investigations of groundwater and hydraulic interactions (including geothermal systems); applications in surface water systems, including sediment transport and hydro-engineering problems; and analytical techniques related to isotope and chemical analyses of water samples for hydrological applications.

32. ECA is currently preparing an inventory of existing conventions, treaties and agreements on shared water resources in Africa. ESCAP has focused its activities in this area on the introduction of computer applications for the assessment of water resources in its region, through the publication of several documents, the organization of workshops and several advisory missions. ESCWA has been responsible for several activities aimed at improving water resources assessment in western Asia.

D. Capacity-building to enhance participatory approaches and improve institutional and regulatory frameworks

33. All ACC Subcommittee members are involved, in one way or another, in various capacity-building activities in the field of water resources. UNDP technical cooperation programmes are concentrating their efforts on applying capacity-building strategies for creating an enabling environment with appropriate policy, legal and regulatory frameworks; institutional development, including community participation; human resources development and strengthening of managerial systems; and information networks. The Global Capacity-Building Programme for Sustainable Water Sector Development, which is partly funded by UNDP, is designed to produce a process of capacity-building initiated by a water sector assessment; a nucleus of officials and specialists trained in sustainable water sector development; water sector assessment reports, including planning frameworks; improved cross-sectoral collaboration; and improved coordination among national agencies and external support agencies.

E. Financing of water resources development and utilization

34. The magnitude of the involvement of organizations of the United Nations system in the field of water resources can be appreciated from the expenditures on technical cooperation activities of the two major funding agencies in the system. UNDP funding to over 121 ongoing water projects in about 60 developing countries and those with economies in transition amounts to US$ 192 million. World Bank loans to 240 water projects (or natural resources projects with major water components) implemented during the 1990s in about 80 developing countries and countries with economies in transition amounted to over US$ 21 billion. In addition, the grants and concessional funds disbursed by the Global Environment Facility (GEF) during fiscal year 1996 amounted to US$ 37.7 million. Also during 1996, the Project Preparation and Development Facility of GEF provided US$ 1.9 million for the formulation of seven projects in this area from the initial concept stage through final design.

35. Several other major United Nations organizations involved in the field of water resources, such as FAO and UNICEF, also provide substantial funds for the implementation of many projects in their respective core areas of activity. Between 1994 and 1996, for example, UNICEF expenditures on water supply and sanitation activities (excluding expenditure on emergency water supply and sanitation activities) amounted to no less than US$ 220 million. In addition, a significant amount of regular budget and extrabudgetary funds is usually allocated by ACC Subcommittee member organizations for activities supporting technical cooperation programmes, including (a) data collection and analysis; (b) preparation of studies and reports; and (c) organization of workshops, seminars and conferences.

36. UNDP is currently involved in the testing of innovative financing mechanisms in Senegal and South Africa aimed at attracting loans from local banks and other credit institutions for community water supply, small-scale irrigation and sanitation. Local banks are interested provided that the project generates a cash flow (from income-generating activities, such as small-scale irrigated agriculture and cottage industry) and their loan can be protected from default by loan guarantees from another bank or fund. Local non-governmental organizations are involved in order to provide technical and administrative support to the communities. The World Bank is also providing increasing attention to programmes that make formal financial services available to the rural and urban poor, including consultation with other donors regarding long-term support and funding for micro-credit programmes, and financial assistance for the establishment or support of financial institutions providing credit for lower-income groups in developing countries. As mentioned above, UNICEF has also promoted the empowerment of women through such initiatives as women-managed water committees and micro-credit schemes for income generation.

III. Strategic responses by the organizations of the United Nations system

37. Given the complexity of water resources issues and the nature of mandates of different organizations of the United Nations system, a certain amount of overlap and even duplication is, at times, inevitable. It is not possible to have an absolute demarcation of responsibilities. What is of paramount importance is that the organizations proceed on the basis of a common understanding of basic principles and approaches, that they have on-going information about each other's activities in order to enhance cooperation and avoid duplication, and that they increase cooperation concerning country-level activities.

38. The ACC Subcommittee on Water Resources increasingly provides channels of communications through its formal sessions, informal communications and various cooperative arrangements. Additional steps towards enhancing the flow of information are being taken through the linking of World Wide Web sites of the various organizations. In order to improve coordination of activities at the field level, the members of the ACC Subcommittee are now initiating a process of organizing a working group composed of their experts working in the field in support of resident coordinators' efforts.

39. Because of the role of the regional commissions with regard to assistance in implementing Agenda 21 within their respective regions, they can be instrumental in coordinating system-wide activities at the regional level. In this regard, the various coordination efforts being carried out throughout the system, particularly through the Subcommittee, need to benefit from the regular participation of the regional commissions.

40. Governments and the international community face many challenges in the road towards achieving the sustainable development and management of water resources. Approaches and issues regarding the activities of the organizations concerning these strategic questions are described below.

A. Water for socio-economic development

41. A major challenge facing organizations of the United Nations system is to assist Governments in bringing about coherent institutional approaches by outlining a set of policy and management options based on the principle of efficiency, equity, participation and sustainability. There is now a clear understanding of the need to formulate concerted approaches to integrated water resources development and management. A World Bank policy paper,[2] the general framework formulated by FAO on behalf of the ACC Subcommittee on Water Resources,[3] a report prepared by the former Department of Development Support and Management Services of the United Nations Secretariat for the third session of the Committee on Natural Resources,[4] and the report of a UNDP international symposium on a strategy for water resources capacity-building provide a basis for this common understanding.[5]

42. Notwithstanding the need for integration, the efficient management of sectoral issues remains essential. Nothing short of a major international programme, particularly with regard to environmental sanitation, involving local and national authorities, the international community, non-governmental organizations and the private sector, will suffice to accelerate and sustain the satisfaction of these basic human needs. The management of water resources for agricultural purposes remains essential in order to minimize its wasteful use to control pollution and avoid land degradation.

43. At the country level, efforts to integrate these conceptual approaches are evident in such programmes as the FAO International Action Programme on Water and Sustainable Agricultural Development. Activities concerning water supply and sanitation are increasingly carried out in the context of an integrated approach. Nevertheless, for the most part, cooperation with Governments with regard to sectoral issues does take place in the context of the fragmented institutional arrangements that exist in countries in which such cooperation is taking place. Organizations dealing primarily with sectoral issues, (FAO, WHO, UNICEF, UNIDO) need to work together with those organizations dealing with broader aspects of water resources development and management (Department of Economic and Social Affairs, UNDP, World Bank, FAO and the regional commissions) in order to ensure support in the integrated management efforts of Governments. This can be, and is being achieved, via diagnostic studies conducted by Governments in order to determine institutional constraints and remedies, as well as to define overall priorities, objectives and sectoral requirements.

B. Health and productivity of aquatic ecosystems and impact on human health of the degradation of water resources

44. The interrelation between land, water resources, the health of coastal areas and oceans and the health of ecosystems is one of the most neglected areas of water resources management. The existing evidence suggests that the economic losses resulting from the loss of natural capital as a result of the degradation of ecosystems and the loss of human productivity from water-borne diseases often far exceeds the short-term benefits that may be derived from development schemes that ignore such consequences.

45. Increased attention is being given by the organizations of the United Nations system to the close relationship that exists between land and water development and the degradation that one can inflict upon the other. Ultimately, however, the effectiveness of these programmes will hinge on the extent to which they become an integral part of the system's concerted efforts in assisting Governments in devising approaches to the integrated management of their

water resources. These programmes need to be seen in the light of the support provided to Governments in the implementation of water-related concerns of the convention on desertification and drought, biological diversity and climate change, and the International Decade for Natural Disaster Reduction, as well as the implementation of the Global Plan of Action for the Protection of the Marine Environment from Land-based Activities and the comprehensive assessments carried out by the Intergovernmental Panel on Climate Change, particularly its second assessment report (see FCCC/SBSTA/1996/7/Add.1, 2 and 3), published in 1995, which includes chapters on hydrology, freshwater ecology and water resources management.

C. Information management

46. The comprehensive assessment of the freshwater resources of the world (E/CN.17/1977/9) showed that the capability to provide accurate water quality and quantity data is sorely lacking in the majority of countries, and that for years the capacity of hydrology offices in developing countries, particularly in Africa, has been declining. For the most part, knowledge about ground water resources is inadequate. The assessment also concluded that it is difficult to obtain reliable, systematic information on water resources management in most developing countries, and that there is a scarcity of good data on water use and land degradation related to water use. The hardship incurred by national programmes in these domains as a result of budgetary constraints has been needlessly exacerbated by a fragmentation of national agencies dealing with water resources assessment and by the lack of linkages to the water management process. At the country level, organizations of the United Nations system need to develop concerted approaches in order to assist Governments in the formulation and implementation of integrated information strategies aimed at maximizing the development and management value of information.

47. The seriousness of the situation with regard to the sustainable development and use of water resources worldwide warrants the periodic re-examination of progress and trends towards more sustainable pathways. However, the scope and extent of the analysis undertaken for comprehensive assessments will continue to be limited by both the scarcity of reliable information and the absence of national and international harmonized information systems and common methods of analysis of information unless steps are taken to improve the current situation. With regard to water quality, members of the ACC Subcommittee on Water Resources are in the process of developing a comprehensive water quality programme based on a carefully selected global network of representative drainage basins encompassing a broad spectrum of environments so that future extrapolation to unmonitored basins can be achieved. Given the need for the integration of existing information systems, the members of the Subcommittee are also taking steps towards linking various Web sites with a view to facilitating access to available information and facilitating the harmonization of methodologies.

D. Capacity-building to enhance participatory approaches and improve institutional and regulatory frameworks

48. In view of the ever-increasing complexity of water resources issues, United Nations system organizations need to strive towards providing an integrated capacity-building framework in support of national efforts. National water sector assessments should thus be considered as a starting point for the identification of capacity-building needs and priorities, as well as the definition of capacity-building programmes, within the broader context of integrated water resources management. National Governments and United Nations organizations need to engage in long-term commitments to facilitate programmes for capacity-building as a steady and continuing process. Opportunities need to be taken for the networking of institutions, in particular for the exchange of experience and capacities among developing countries.

E. Financing of water resources development and utilization

49. The enhancement of the effectiveness of United Nations system support provided to Governments in the formulation of policies for the generation and effective utilization of financial resources hinges on the ability of such support to assist Governments in fostering an enabling environment that encourages investments from both public and private sources, and in designing and implementing pricing policies for cost recovery, efficient allocation of water and water conservation, taking into account the country's level of development. This is of particular significance with regard to financing water supply and sanitation in fast-growing urban and peri-urban areas, as

well as for the organization of poor rural communities to enable them to generate the required financial resources.

50. Financial assistance in terms of grants and loans provided by the organizations of the United Nations system are and will remain small relative to total requirements. Nevertheless, in addition to the more traditional grants and loans, they can play an important role in leveraging investments from other sources, notably regional banks and funds, bilateral agencies, non-governmental organizations, national financial organizations and the private sector, including commercial banks. Organizations of the United Nations system can assist and are already assisting Governments to forge partnerships with the private sector, in the context of large urban areas and in leveraging activities in the form of loan guarantees or small loans for community water supply schemes in small towns, peri-urban areas and rural communities or for small-scale irrigation projects.

Notes

[1] The membership of the Subcommittee comprises Department of Economic and Social Affairs, Economic Commission for Africa, Economic Commission for Europe, Economic Commission for Latin America and the Caribbean, Economic and Social Commission for Asia and the Pacific, Economic and Social Commission for Western Asia, United Nations Children's Fund, United Nations Development Programme, United Nations Environment Programme, United Nations Centre for Human Settlements (Habitat), Office of the United Nations High Commissioner for Refugees, United Nations University, International Research and Training Institute for the Advancement of Women, secretariat of the United Nations Convention on Biological Diversity, secretariat of the United Nations Convention to Combat Desertification, secretariat of the United Nations Framework Convention on Climate Change, secretariat of the United Nations International Decade of Natural Disaster Reduction, Food and Agriculture Organization of the United Nations, United Nations Educational, Scientific and Cultural Organization, World Health Organization, World Bank, World Meteorological Organization, United Nations Industrial Development Organization, and International Atomic Energy Agency.

[2] See World Bank, *Water Resources Management* (Washington, D.C., 1993).

[3] Food and Agriculture Organization of the United Nations, *Water Sector Policy Review and Strategy Formulation: A General Framework* (Rome, 1995).

[4] Report of the Secretary-General on institutional and legal issues relevant to the implementation of water markets (E/C.7/1996/3).

[5] See IHE/UNDP, *A Strategy for Water Sector Capacity-Building* (New York, 1991).